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MAJOR PROGRAMS

UPDATE

BILL SWEETMAN

ALL-SEEING EYE

"Maneuverability is irrelevant." That quote from a Northrop Grumman video underlines the fact that an often neglected attribute of the Lockheed Martin F-35 Joint Strike Fighter (JSF)—use of the AAQ-37 Distributed Aperture System (DAS)—has driven major features of the aircraft.

DAS imagery will be presented on Vision Systems International's helmet-mounted display.

DAS (for which Northrop Grumman is prime contractor) comprises six identical fixed, staring infrared (IR) imagers located around the aircraft. It has five basic functions: missile detection and tracking; launch-point detection; situational awareness (i.e., 360-deg. IR search-and-track capability); weapons support, and day-night navigation. It can provide target and track data to the aircraft's systems (where it is fused with other sensor inputs to drive the displays) or feed imagery to the pilot's helmet-mounted display, or HMD.

Range performance is classified, but depends on environmental conditions and characteristics of the target. Ground targets can be ranged using digital terrain data, and there are passive ranging techniques that can be used against airborne targets.

The revolutionary application of DAS is air-to-air tracking. As a staring system, DAS has video-type revisit rates and optical accuracy, and can track unlimited targets continuously. The result is that it does not need to recognize targets by their signatures, because it maintains their identities throughout their history. In a formation of JSFs, for example, DAS will constantly track the friendlies, and continue tracking them regardless of position or maneuvering. Once radar, identification-friend-or-foe (IFF) or offboard sources have declared other targets hostile or neutral/unidentified, DAS will also maintain their tracks. The tracking is claimed to be accurate and reliable enough to cue weapons in a lock-on after launch (LOAL) mode.

Pete Bartos, manager for business development at Northrop Grumman, points out that this can change the nature of air combat. DAS eliminates blind spots: if a fighter is closing on the JSF from astern, DAS should detect it and allow a high off-boresight (HOBS) defensive missile shot. Since the adversary is running into the missile, kinematics favor the defender.

In a classic head-on engagement, the use of agile HOBS missiles can result in a mutual kill as two fighters reach the merge, slowing down and each entering the no-escape zone of the other's weapons. With DAS, the alternative is to "accelerate out of the fight"—JSF is aerodynamically clean and has a powerful engine—while using DAS to take an over-the-shoulder LOAL shot as the adversary turns to engage.

At that point, too, Bartos suggests, the JSF pilot may get better situational awareness head-down, using a God's-eye view of the fight on the fighter's widescreen displays, than by trying to acquire targets visually with the aid of the HMD. "The reason that you're moving your head around all the time is that you don't know who the other guy is," Bartos points out. DAS should reduce or eliminate that uncertainty.

Bartos, who, as a U.S. Air Force fighter pilot, was involved with drafting JSF requirements, says that planners realized DAS would be available for JSF, and accordingly accepted "F-16-like" maneuverability for the fighter. Super maneuverability—in particular, the ability to maintain control after the stall and point the nose quickly at low speeds—"is a dangerous place to hang out," Bartos says. With a higher wing loading than the F-22, no thrust vectoring and smaller controls, JSF is not designed for post-stall agility; instead, the idea is to use DAS, HOBS and LOAL to win a defensive fight.

There are limits to JSF's ability to exploit this technol-

ogy. The AIM-120 advanced medium-range air-to-air missile (Amraam) is not designed for close-in HOBS engagements, its kinematics being optimized for range rather than agility. The U.K.'s MBDA Asraam (short-range) missile or the forthcoming Raytheon AIM-9X Block II, both fitted with a data link, are better suited to the job, but so far JSF can only carry those weapons externally, severely compromising its stealth.

The basic functions of DAS do not represent the system's full capability, Bartos says, pointing out that the requirement was written when processor and memory limits were much tighter. Potential capabilities include optical tracking of moving ground targets, the ability to detect artillery fires and the ability to record some DAS imagery for intelligence, surveillance and reconnaissance. A DAS derivative could also be an adjunct wide-area sensor for a UAV, combined with a multi-terabyte recording system. Northrop Grumman is working on a cheaper, lighter DAS-type system for helicopters, using uncooled sensors.

DAS is being tested along with the JSF's APG-81 radar on Raytheon's BAC One-Eleven testbed. It is not expected to fly on Lockheed Martin's CATBird (cooperative avionics testbed) until the fall of 2009. ■